

CLAIMS

1. Process for the rapid prototyping by sintering in solid phase, with a laser, of (a powder or mixture of powders, particularly ceramic,) characterized in that it comprises the steps which consist in:

1/ obtaining a series of digitized superposed sections (10) of an object (12) to be produced, from a three-dimensional representation of said object,

2/ spreading in the form of a thin layer (14) the powder or mixture of powders heated to a temperature near the sintering temperature in solid phase, of said powder or said mixture of powders,

3/ bringing the layer (14) to the sintering temperature by sweeping with a laser beam (16) said layer such that a selected portion (18) of the powder, which corresponds to one of the digitized sections (10') of the object (12) to be produced, is sintered in solid phase thanks to the supplemental energy supplied by the laser,

the steps 2 and 3 being repeated until all the digitized superposed sections of the object to be produced are obtained.

2. Process according to claim 1, characterized in that it comprises the steps which consist in:

1/ obtaining a series of digitized superposed sections (10) of an object (12) to be produced, from a three-dimensional representation of said object,

2/ spreading in the form of a thin layer (14) the powder or mixture of powders heated to a temperature near the sintering temperature in solid phase of said powder or said mixture of powders,

3/ increasing the density of the powder of the layer (14),

4/ bringing the layer (14) to the sintering temperature by sweeping with a laser beam (16) said layer such that a selected portion (18) of the powder, which corresponds to one of the digitized sections (10') of the object (12) to be produced, is sintered in solid phase by the supplemental energy supplied by the laser,

the steps 2, 3 and 4 being repeated until all the digitized superposed sections of the object to be produced are obtained.

3. Process according to claim 2 ~~or 3~~, characterized in that the powder or mixture of powders is heated and held at a temperature of the order of 300°C to 900°C.

4. Process according to claim 2 ~~or 3~~, characterized in that the layer (14) is mechanically compacted so as to increase its density.

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5. Process according to ~~any one of the preceding~~ claims, characterized in that the laser which is used is a pulsed YAG laser, and that the wavelength of the emitted radiation is in the near infrared.

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6. Device for practicing the process according to ~~any one of the preceding~~ claims, characterized in that it comprises a laser (24) provided with means (30) for controlling the stroke subject to a computer interface, a high temperature cell (32) provided with heating means (74) and a target (43) for a beam (32) of the laser (24), and means (86) for laying down in layer form, disposed in said cell (62), adapted to deposit on the target (43), a layer (92) of powder.

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7. Device according to claim 6, characterized in that it comprises compacting means (88), disposed in the high temperature cell (62), adapted to compact the layer (92) before sintering.

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8. Device according to claim 6 ~~or 7~~, characterized in that the cell (62) is delimited in its lower portion by a horizontal plate (26) which comprises two openings (34, 36), prolonged below the plate (26) by first and second cylinders (38, 40), in each of which can move a piston (44; 46), the first cylinder (38), disposed in prolongation of the beam (34), constituting the target (43), and the second cylinder (40), disposed adjacent the first, constituting a reservoir of first material in powder form, and in that the means (86) for laying down a layer are adapted to transfer the powder from

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the second cylinder toward the first, so as to deposit it in the form of a layer (92), the compacting means (88) being adapted to compact said layer (92).

9. Device according to claim 8, characterized in that the two pistons (44, 46) are provided respectively with control means (52, 54) subject to the computer interface.

a 10. Device according to ~~any one of claims 6 to 9~~, characterized in that the high temperature cell (62) is delimited in its upper portion by a thermally insulating chamber (60) which comprises a window (78), in prolongation of the laser beam (32), provided with filter means (80) in the form of at least one lens (82), which let pass near infrared radiation of the laser to the interior of the cell (62) but which filter out radiation emitted by the black body constituted by the cell (62) toward the laser.

a 11. Device according to ~~any one of claims 8 to 10~~, characterized in that it comprises means (56) for measuring the real height of the piston (44), disposed in the first cylinder (38).

a 12. Device according to ~~any one of claims 7 to 11~~, characterized in that the compacting means (88) are in the form of a roller (94), and the layer forming means (86) by a screed (90), connected to said roller (94), the two means (86, 88) being controlled by control means (100) subject to the computer interface.

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